REMARKS

This application has been reviewed in light of the Office Action mailed on April 25, 2005. Claims 1-29 are pending in the application. By the present amendment, Claims 1-3 and 8-25 have been amended. No new matter or issues are believed to be introduced by the amendments.

112, Second Paragraph

Claims 2-7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22 and 24-29are rejected under 35 U.S.C. §112, second paragraph.

The Examiner states that with regard to Claims 2, 9, 12, 15, 18, 21 and 24, the limitation, "wherein D_a has a substantially maximum value", is vague and indefinite. Specifically, there is an absolute maximum value of D_a and therefore the meaning of substantially maximum is unclear and therefore rendered vague and indefinite. Claims 2, 9, 12, 15, 18, 21 and 24 have been amended in a manner which is believed to overcome the rejection.

The Examiner states that with regard to Claims 3, 10, 13, 16, 19, 22 and 25, the limitation, "H_l has a substantially minimum value", where H_l is the average hamming distance between all pairs, is vague and indefinite. The Examiner states that there is an absolute maximum value of H1, and therefore the meaning of substantially maximum is unclear and therefore rendered vague and indefinite. Claims 3, 10, 13, 16, 19, 22 and 25 have been amended in a manner which is believed to overcome the rejection.

The Examiner states that with regard to Claims 4-7 and 26-29, the use of the phrase, "or an equivalent signal constellation thereof", is not precise in meaning and is therefore rendered vague and indefinite. In response, it is respectfully submitted that the phrase ""or an equivalent signal constellation thereof" is supported throughout the specification. The term "equivalent" is described in the specification as a re-ordering of the entries of each of the labels of the constellation using a certain fixed permutation (i.e., switching the first and second entries in each of the labels). Support is found at pars. 32 – 38, re-stated herein:

[0032] All possible signal constellations may be grouped into classes of <u>equivalent signal constellations</u>. The signal constellations from the same equivalence class are characterized by the same sets of Euclidean and Hamming distances. Therefore all signal constellations of a given equivalence class are equally good for our purposes. [Emphasis Added]

[0033] There are some obvious ways to produce an equivalent signal constellation to any given signal constellation. Moreover, the total number of equivalent signal constellations that may be so easily inferred from any given signal constellation is very big. The equivalence class of a given signal constellation is defined as a set of signal constellations that is obtained by means of an arbitrary combination of the following operations:

[0034] (a) choose an arbitrary binary m-tuple and add it (modulo 2) to all labels of the given signal constellation;

[0035] (b) choose an arbitrary permutation of the positions of m bits and apply this permutation to all the labels;

[0036] (c) for any QAM constellation, rotate all signal points together with their labels by 1 1 2 , 1 1 3 ;

[0037] (d) for any QAM constellation, swap all signal points together with their labels upside down, or left to the right, or around the diagonals;

[0038] (e) for PSK, rotate all signal points together with their labels by an arbitrary angle.

Withdrawal of the rejection with respect to Claims 4-7 and 26-29 is respectfully requested.

35 U.S.C. §103(a)

In the Office Action, Claims 1, 8, 11, 14, 17, 20 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,662,337 – Brink and U.S. Patent No. 5,0544,036 – Brownlie.

With respect to Claim 1, Fig. 4 of Brownlie is cited by the Examiner to cure a deficiency in Brink. Brownlie is cited for teaching: "*...wherein the signal constellation comprises a number of signal points with corresponding labels, and wherein* $D_a > D_f$, *with* D_a *being the minimum of the Euclidean distances between all pairs of signal points whose corresponding labels differ in a single position, and with* D_f *being the minimum of the Euclidean distances between all pairs of signal points.*"

Independent Claim 1 has been amended herein to better define Applicant's invention over Brink and Brownlie, individually and in combination. Claim 1 now recites limitations and/or features which are not disclosed by Brink and Brownlie, individually and in combination. In particular, Applicant's presently amended independent claim 1 recites

1. (Currently Amended) A transmission system for transmitting a multilevel signal (x_k) from a transmitter (10) to a receiver (20), the transmitter (10) comprising a mapper (16) for mapping an input signal (i_k) according to a signal constellation onto the multilevel signal (x_k), the receiver (20) comprising a demapper (22) for demapping the received

multilevel signal (y_k) according to the signal constellation, wherein the signal constellation comprises **2^m** signal points with corresponding labels **of m bits in length**, and wherein $D_a > D_f$, with D_a being the minimum of the Euclidean distances between all pairs of signal points whose corresponding labels differ in a single position, and with D_f being the minimum of the Euclidean distances between all pairs of signal points.
[Emphasis Added]

It is respectfully submitted that the cited references, individually and in combination, do not disclose or suggest Applicant's invention as recited by Claim 1 as amended.

Brownlie discloses in the Abstract, a trellis coder including a convolutional encoder which has n states and can progress from a current state to a follower state depending on an input. The state progressions are selected such that they can be represented by a diagram having 90 degree rotational symmetry. Brownlie further states in the Summary (Col. 1, lines 63 – 67) that the convolutional coder includes input means responsive to a single bit input stream supplied thereto to produce a binary input to the convolutional coder to control state transitions such that one bit value gives rise to a signal of phase difference a or b from the preceding signal and the other bit value gives rise to a signal of phase difference c or d from the preceding signal, where a, b, c and d are different ones of the values 0, 90, 180 and 270 degrees.

Fig. 4 of Brownlie illustrates a capability to control state transitions such that one bit value gives rise to a signal of phase difference a or b from the preceding signal and the other bit value gives rise to a signal of phase difference c or d from the preceding signal by using a signal constellation comprised of **2^m** signal points, where **m=2** with corresponding labels of the signal constellation being **m bits in length, where m=3.**

Brownlie discloses a modified version of a coder according to one of the V32 or V33 standard. Groups of input bits Q1-Q4 are coded to derive five output bits {Q4 and Q3, unmodified, and Y2, Y1, Y0} to designate a signal point to be generated. The 5 bit number YOY1Y2Q3Q4 is carried out by a mapping which produces quadrature outputs which drive a quadrature modulator. Those points having the same YOY1Y2 are referred to as a 'subset' of the constellation. The 'subset' of the constellation, as shown in Fig. 4 of Brownlie, illustrate a signal constellation having labels of m bits in length, where m=3. However, the signal constellation of Brownlie is comprised of **<u>2^m</u>** signal points, where **<u>m=2.</u>** Brownlie teaches at Col. 2, lines 59-60 that, "*Taking the V32 (9600 bit/s) code, this codes 4 bits per symbol, but employs 32 signal points in the QAM phase diagram as compared with the 16 required for modulation not employing a trellis code.*"

It is therefore respectfully submitted that Brownlie does not teach *wherein the signal constellation comprises a number of signal points with corresponding labels, and wherein $D_a > D_f$, with D_a being the minimum of the Euclidean distances between all pairs of signal points whose corresponding labels differ in a single position, and with D_f being the minimum of the Euclidean distances between all pairs of signal points*" wherein the signal constellation comprises **<u>2^m</u>** signal points with corresponding labels **<u>of m bits in length</u>**, as recited in amended Claim 1.

Accordingly, it is believed that Applicant's Claim 1 recites patentable subject matter, and therefore, withdrawal of the rejection with respect to Claim 1 and allowance of Claim 1 is respectfully requested.

Claims 2 - 7 depend from Claim 1, and therefore include the limitations of Claim 1. Accordingly, for the same reasons given above for Claims 1, Claims 2-7 are believed

to contain patentable subject matter. Accordingly, withdrawal of the rejection with respect to Claims 2 - 7 and allowance of Claims 2 - 7 are respectfully requested.

Independent Claims 8, 11, 14, 17, 20 and 23 recite similar subject matter as Claim 1. Hence, for at least the same reasons given for Claim 1, Claims 21 recite patentable subject matter, and therefore, withdrawal of the rejection with respect to Claims 1 and allowance of Claim 1 is respectfully requested.

Claims 12-13, 15-16, 18-19, 21-22 and 24-29 depend from Claims 8, 11, 14, 17, 20 and 23, respectively, and therefore includes the limitations of Claim 8, 11, 14, 17, 20 and 23. Accordingly, for the same reasons given above for Claims 8, 11, 14, 17, 20 and 23, Claims 12-13, 15-16, 18-19, 21-22 and 24-29 are believed to contain patentable subject matter. Accordingly, withdrawal of the rejections with respect to Claims 12-13, 15-16, 18-19, 21-22 and 24-29 and allowance of Claims 12-13, 15-16, 18-19, 21-22 and 24-29 is respectfully requested.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1-29 are believed to be in condition for allowance and patentably distinguishable over the art of record.

Respectfully submitted,

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